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calmness, there may, on the other hand, be those who are so deeply interested in the material success of electric telegraph connection with America, as to be drawn into an eager contest to set up the merits of one scheme in preference to those of another. Should there be any gentlemen present prepared to carry these feelings into the discussion, I feel assured they will remember this, that it is those who are beaten that generally complain, and that the man who is the winner at chess is not the man to throw the pieces at his adversary's head. I believe we shall have no symptoms of distress exhibited; that we shall not have anybody manifesting the conviction passing in his mind that he is worsted in the argument. I will now call upon Sir Leopold McClintock to read the first paper that is set down on the list.

The Papers read were—

1. *Surveys of H. M. S. Bulldog.* By Capt. SIR F. LEOPOLD MCCLINTOCK, R.N., F.R.G.S.

IN compliance with a request from the promoters of the North Atlantic Telegraph Route, Her Majesty's Government despatched the *Bulldog* under my command, on the 1st of July last, with orders to ascertain the depth of the ocean, and as far as possible the nature of the bottom, between the Færøe Islands and Iceland, Iceland and Greenland, and between Greenland and Hamilton Inlet on the Labrador coast. I was also directed, should my time permit, to make a slight examination of that inlet—being British territory; but in no other instance did my duty extend to the examination of any of the coasts I was required to approach. With the exception of Hamilton Inlet, none of the positions for the shore-ends of the proposed lengths of cable were suggested when I sailed from England. The duty of selecting them was subsequently entrusted, by the promoters of this Telegraph Route, to Captain Allen Young in the *Fox*; consequently, my lines of soundings have not in every instance been carried in from the deep sea, so as to unite exactly with the coast explorations of Captain Young.

Although my visit to the Færøe Islands was not for the purpose of making any examination of their shores, yet I could not fail to observe that a submarine cable, in connection with the main island, and a land-wire across it, could be maintained with perfect ease. In my official report to the Secretary of the Admiralty, written previously to my return to England, and which I shall have frequent occasion to quote, I have remarked that on landing at Thorshaven, the chief town of the islands, I observed that the little bays near it afforded ample shelter and security for any cable landed within them. The best harbour in the group is Westmanshaven, but it is situated in a channel through which the tide runs fully six miles an hour, and for this reason it would not be advisable to bring the cable there.

I was informed that the channel between the islands of Stromöe and Osteröe is almost obstructed in the middle, being contracted to fifty or eighty yards; hence there can be but a very slight flow of tide through it, and upon this account I would seek a landing-place for the Iceland cable near to the north-west outlet of this channel, at Haldervig or Eide.

Leaving the Færöe Isles on the 6th of July, we sounded across towards Ingolfsholde upon the south-east shore of Iceland, a distance of 280 miles, and found the depth to be generally less than 300 fathoms, the greatest depth being 680 fathoms. The specimens of the bottom consisted chiefly of fine sand, or mud and broken shells, and, in two instances, of minute volcanic débris; the temperature of the sea at 100 fathoms below the surface scarcely varied from 46°. The depth of water upon this section of the telegraph route is so moderate that it would be an easy matter to lay down a cable between Færöe and Iceland. Since my return I find that Beru Fiord, upon the east coast of Iceland, has been examined with a view to its selection as the landing-place for a cable; it is about 80 miles to the north-east of Ingolfsholde, and has the advantage of being somewhat nearer to Færöe.

On the 11th of July I arrived at Reikiavik, the chief town of Iceland; an expected supply of coals had not arrived, therefore I remained only three days, but returned again in October, when my stay extended from the 19th to the 28th. During these visits I obtained some interesting information about its physical aspect, its climatic condition, and the movements of the ice in the adjacent seas. I was informed that a telegraphic wire could not be carried along the south shore eastward of Portland, on account of the many wide rivers which have their sources amidst the mountains and glaciers of the interior. These rivers are much swollen in spring, when they carry down vast quantities of ice, and sometimes change their beds; but to the north of the central mountains no such difficulty would be experienced.

The east and west coasts are very seldom visited by drift-ice, not oftener than seven or eight times in each century, whilst it is only upon two or three of these occasions that the drift of Arctic ice is sufficiently extensive to reach the south coast. True icebergs are *never* seen; the masses sometimes mistaken for them are small enough to float in comparatively shallow water, so that a cable would remain undisturbed at the bottom, its shore-end being carried into a fiord. Faxø Bay, on the south-west coast, enjoys a remarkable exemption from drift-ice; the last mention of its appearance within it is as long ago as 1683: neither does it freeze over—mer-

chant vessels trade there throughout the winter. A cable could therefore be landed in this bay with perfect ease and security, and probably to the westward of Reikiavik.

The entire population of Iceland scarcely exceeds 60,000 souls.

Education is perhaps more generally diffused than in any other country, and the topographical maps recently published by the Danish Government delineate its features most fully, and with the greatest possible accuracy, and would greatly facilitate the survey of a land-line.

Although Iceland is considerably larger than Ireland, and is of volcanic origin throughout, yet for long ages the disturbance occasioned by its subterranean fires has been limited almost exclusively to its south-western quarter, where Hecla is occasionally, and Katla has been very recently, in an active state, and where Geysers and boiling springs are numerous; nor is the adjacent sea free from like convulsions. In 1783 a submarine volcano burst forth in a probable depth of 200 fathoms, about 30 miles off the south-west extreme of the island; by it a new islet was formed; it soon after subsided, but still exists under water as a dangerous sunken rock. This volcano was again active in 1830;* its action appears to have been very limited, and within 4 leagues of it stands the time-honoured "Grenadier's Cap," a basaltic column, 80 feet above the sea; within 500 or 600 yards of this most remarkable rock the *Bulldog* sounded in 70 fathoms. Fortunately the telegraph route is not required to pass, by sea or land, through any part of this disturbed or suspected area. Five days of very calm weather enabled us to complete the line of soundings between Faxø Bay and the south-east coast of Greenland. The depths generally were very regular, the greatest being 1572 fathoms, and situated in mid-channel; but when within 40 miles of Greenland the depth decreased from 806 fathoms to 228 fathoms, in the short distance of $3\frac{1}{4}$ geographical miles.

The nature of the bottom was chiefly ooze, that is, fine mud partly consisting of minute organic remains; but near to Iceland volcanic mud and sand were more frequently brought up. The temperature of the sea at 100 fathoms below the surface gradually diminished from 46° near Iceland, to 39° off the Greenland coast. Circumstances which it is unnecessary to allude to here prevented me from commencing before 18th August the line of soundings between the south-west coast of Greenland and Hamilton Inlet on the Labrador coast, a distance of 550 miles.

* Some interesting notices of this and other submarine volcanoes are published in the 'Nautical Magazine' for July, 1860.

The Greenland shore was still blockaded by such a vast accumulation of drift-ice that we could not approach within 45 miles of it, at which distance the depth was ascertained to be 1175 fathoms. This line of soundings to Hamilton Inlet shows that the greatest depth—which is in mid-channel—is 2032 fathoms; and that the decrease is very gradual until within about 80 miles of Labrador, where there is a change from about 900 fathoms to 150 fathoms in 7 or 8 miles.

The ocean-bed consisted of ooze, but with fewer microscopic organisms than previously met with, whilst the average temperature of the sea at 100 fathoms below the surface was 40°.

Seven days were all I could devote to the examination of Hamilton Inlet. Its length was found to be 120 miles, whilst its width varies from about 15 miles at its mouth to scarcely half a mile at “the Narrows,” which are about half-way up to its head, and above which it expands into an inland sea of about 20 miles in width. All this great inlet was rapidly explored, its main channel from “the Narrows” to seaward was sounded, and the whole laid down by Mr. Reed, master and assistant-surveyor, with sufficient accuracy for ordinary purposes; but these soundings are not nearly sufficient to meet the requirements of a cable-route, nor even to decide whether a cable should be landed there.

We found the depths to be very irregular, and seldom sufficient to secure a submerged cable from disturbance by icebergs. A perfect survey is absolutely necessary, and may show that the shallow water and reefs of rocks, which to our imperfect knowledge appeared intricate and unfavourable, may not only be avoided, but may afford a sure protection against the intrusion of icebergs within the mouth of the inlet. There are some small rocky islets off the mouth of this inlet, and of these the Hern Islets lie nearly in the middle and contract the widest channel of entrance to about 5 miles; the greatest depth obtained in this channel was 49 fathoms. Had the depth of water amounted to 70 fathoms in as far as this position, I would not hesitate in pronouncing favourably of Hamilton Inlet as a terminus to the cable from Greenland.

The greater part of the local information which I obtained here was kindly furnished by Captain Norman, a Newfoundland merchant, who has traded here each successive summer for twenty-four years; during the summer he resides at Indian Harbour, at the north entrance of the inlet, where there is a secure anchorage for vessels of moderate size. Captain Norman states that icebergs very rarely enter the mouth of Hamilton Inlet, and never pass within the Hern Islets; and for these reasons: 1st, that the current

which has borne them from the north is here deflected off-shore by the Esquimaux Islands, and carries them past the mouth of the inlet; and 2ndly, that the flow of water caused by the discharge of several large rivers into the inlet still further aids in carrying the drift-ice and icebergs out to seaward. During winter and spring this drifting ice prevents all access to Labrador; but by June Hamilton Inlet is usually quite free from it.

From Captain Norman I also learned that the deepest water along the coast is off Cape Harrison, and that a large river runs into Byron Bay adjoining it; moreover, Sloop Harbour (which is close to the river) is said to be an excellent one. Unfortunately my time was too limited to admit of any examination of this promising locality. It is very desirable to obtain more information respecting the ice and icebergs upon this coast. It could be furnished by the Newfoundland traders and seal-fishers, and perhaps by persons in the employ of Messrs. Hunt, Henley, and Co., of 8, Broad-street Buildings, E. C., a firm which has maintained an extensive establishment near to Hamilton Inlet for a very long period, fifty or sixty years, I believe. In addition to these sources of information, there are intelligent Moravian missionaries, whose settlements on the Labrador coast have existed for more than one hundred years.

The shores of Hamilton Inlet appear bold, rocky, and almost devoid of vegetation when viewed from the sea; as we advance up it, the land becomes lower, the undulations more gentle, verdure and trees appear, and at its head the whole country is densely covered with spruce, white pine, and white birch, but the tallest trees do not exceed 40 feet. I was informed that the interior is similarly wooded, and has an exceedingly scanty population of Indians, allied to the Cree nation; they all profess Christianity, and are a strictly honest, quiet race. The residents along the shores of this great inlet are of European or mixed blood, and do not amount to 200 souls. During summer they catch cod-fish, herrings, and salmon, and in winter they are occupied in trapping fur-bearing animals.

At the Hudson Bay trading-post upon North-West River, at the head of the inlet, I met Mr. Smith, the gentleman in charge, who kindly supplied me with the only information respecting the interior that I was able to obtain. He seemed to think there would be no difficulty in carrying a wire from here overland to Mingan, on the Gulf of St. Lawrence. The Indians frequently travel from one place to the other, the distance not exceeding 250 miles. Should the cable be taken to this inlet, I would suggest that it be landed upon the south shore, to seaward of "the Narrows," as the tides

run through them with very great velocity. All other parts of the inlet freeze over to a depth of 3 feet, for the winters are very severe. The summers, though short, are no less remarkable for their warmth. At North-West River barley and oats ripen, and potatoes and other vegetables grow tolerably well. Mosquitoes are such an intolerable plague, especially to new comers, that unless their faces are carefully veiled or smeared with camphorated oil, brimstone ointment, or dilute creosote, they cannot either repel or endure their bloodthirsty attacks.

Leaving Labrador on the 17th September, I returned to Greenland for the purpose of completing such soundings as the drift-ice had previously compelled me to leave undone. Being, moreover, very desirous of meeting the *Fox*, and of ascertaining from Captain Young where the cables were to be landed, so that I might continue the deep-sea soundings in to those positions, I visited the settlement of Julianshaab on the 29th September, but no information could there be obtained of the *Fox*. The season was very remarkable for the great quantity of drift-ice which encumbered the shore, and had hitherto prevented vessels from approaching Julianshaab; in fact, so much ice had not been known for nearly thirty years. This coast, I may remark, is usually quite free from ice by September. Following up my inquiries, I learned that the climate is not nearly so severe as is generally supposed, the fiords are only partially frozen over in winter; a few cows, goats, and poultry are reared; and although the summers are cold, turnips, spinach, lettuce, and radishes grow in the open air.

I was informed that the large fiord of Tessermiut, which lies midway between Julianshaab and Cape Farewell, was the most likely place to afford security for a cable: that icebergs never came into it, and that there would be found ample depth of water from it out to sea; also that there is safe anchorage in a spacious bay near its mouth as well as high up in the fiord. On 3rd October I put to sea, intending to sound into Tessermiut Fiord, should the ice permit; but it was with difficulty we got out, for a south-east wind had brought up much more ice from Cape Farewell, and prevented our approaching within 40 miles of Tessermiut or the adjoining coast; and the ship sustained considerable damage from unavoidable collisions with the ice before she got clear out to sea. It is well known that a current from the North Atlantic Ocean bears along with it all this ice round Cape Farewell, and up the west coast of Greenland for several hundred miles. It carries the drift-ice for the most part along the outer islands, and it is only when there is a strong wind blowing in from the sea that the ice

comes in between the islands and enters the fiords; it is almost exclusively low or flat ice which thus drifts in, the larger masses and icebergs, which draw more water, nearly always keep in the main stream along the outer islands.

It is evident that were a cable brought in from the deep water existing outside and between these islands, and carried sufficiently far up a deep fiord, its security from icebergs would be insured; and that to protect the mere shore-end from the ordinary flat-ice would be a matter of no great difficulty.

Since my return to England I have received a letter from the Resident Inspector of South Greenland, the well-known Dr. Rink, whose writings on Greenland have added so largely to our knowledge of the physical condition of that great Arctic continent. The opinion of such a man deserves serious attention, since it is scarcely possible to quote a higher authority upon the point in question. I therefore do so almost in his own words.

"I have thought much," he writes, "over the proposed route for the North Atlantic Telegraph; at first I doubted the possibility of accomplishing it, but now I am of a contrary opinion. You can lay down the cable from Iceland round Cape Farewell into some fiord upon the south-west coast, where ice cannot ground upon it, or touch it except for a few fathoms out from the shore, and this last part may be easily protected. But to carry the wire across the interior of Greenland, as I have heard of, would be impracticable." This letter was written in Greenland, before either the *Bulldog* or *Fox* had arrived there, and experience has since shown the necessity for acting in accordance with the suggestion of Dr. Rink. The length of cable required to unite Iceland with West Greenland will be about 800 miles.

Finding that nothing more could be done upon the Greenland coast, I commenced a line of soundings towards Roekall, but a succession of tremendous storms and want of fuel prevented the completion of this service. One of the few casts obtained deserves particular mention; the depth was first ascertained to be 1260 fathoms: then a sounding-machine was lowered to obtain a specimen of the bottom, and about 50 fathoms of line more than the depth required was payed overboard to ensure its being down. On hauling it in, several small star-fishes were found adhering to that part of the line which had lain upon the bottom! The nearest land at the time was Iceland, and it was 250 miles distant. I simply mention this interesting fact, which I witnessed, leaving it to be enlarged upon by Dr. Wallich, the able naturalist of the Expedition, who is still employed by the Admiralty in the micro-

scopic examination of our specimens of the sea-bottom. The result of his investigations (which will be published hereafter) may be of great importance to Marine Telegraphy, proving, as it will do, the existence of animal life at very great depths.

We are aware that the coating of a Mediterranean cable was attacked by minute creatures allied to the ordinary *Teredo*,* at the depth of 60 or 70 fathoms, and should it be found that similar boring animals exist in great depths, it will become imperative to protect the insulation of the wire against their ravages; but time does not admit of a digression from the object of this paper, which is simply to lay before you my experience and opinion with regard to the physical aspect of the proposed route; it may not, however, be out of place to mention that the great pressure exerted at depths approaching to 2000 fathoms is sufficient to squeeze the tar freely out of rope: could we recover a cable from these depths, we should find the tar similarly expressed from its canvas wrappings. If the tar used were of a sufficiently viscid description to harden and remain coated upon the wrappings, it would probably afford quite a sufficient protection against these destructive creatures.

Once laid in deep water, the North Atlantic Cable will probably be more secure and more durable than any other; as it will lie at the bottom of a sea where the temperature is unusually low, and where animal life is proportionately rare.

If, during the coming summer, a final selection and survey of a landing-place in Greenland be made, all that will remain to complete the entire route will be a landing position in Labrador; and that a cable can be safely landed upon some part of this coast, if not in Hamilton Inlet, it is hardly possible to doubt.

Judging then from my own experience, and from the facts which the voyage of the *Bulldog* has brought to light—many of which are supported by the most reliable local authorities—I am of opinion that with regard to the practicability of laying a North Atlantic cable there are no grounds for serious misgivings; on the contrary, nearly all the information which has so far been ascertained is of a kind favourable to the accomplishment of the undertaking.

That there is usually impenetrable ice upon the south-west coast of Greenland for eight months out of the twelve—(i.e. from January until September)—we are well aware; and hence originates the chief difficulty of the route. It is obvious that the Greenland cables cannot possibly be laid down whilst this ice remains upon the coast; but in ordinary seasons it does not clear away until

* See a Paper by J. Gwyn Jefferys, F.R.S., on 'The British Species of *Teredo*,' published in 'The Annals and Magazine of Natural History' for August, 1860.

autumn is far advanced, and stormy weather becomes frequent. This difficulty, I apprehend, however, is not an insuperable or extraordinary one, since it is common to all similar operations at sea requiring for their accomplishment a like period of four or five consecutive days.

I have assumed that the ice ceases to obstruct the south-west shore of Greenland about the middle of September; but we can no more predict its movements than we can foretel the temperatures of the seasons, and the winds by which those movements are governed.

Exceptional seasons occur when it would be imprudent to attempt laying a Greenland cable: also rare seasons when it could be laid as early as July: again, there are seasons when the icedriffs are detached from each other, so that vessels watching their opportunity may freely pass into harbour or out to sea during the summer months.

In order to meet these ever-varying circumstances, it is the more necessary that the utmost caution be observed in all matters connected with the laying down of the Greenland lengths of the great cable; that the most suitable steamers be selected, and the highest engineering and nautical skill be employed.

And that this country possesses all the needful appliances and the amount of professional talent requisite for the accomplishment of this great undertaking, is no more to be doubted than that she possesses men of sagacity to appreciate its vast utility, and of commercial enterprise to bring about so desirable an issue within the next two or three years.

The second Paper read was—

2. *Synopsis of the Surveys of the Fox, under the Command of Capt. ALLEN YOUNG, F.R.G.S.* By Sir CHARLES T. BRIGHT, F.R.G.S.

I HAVE been requested by the promoters of the North Atlantic Telegraph to present to the Royal Geographical Society a synopsis of the report which has been handed to me by Captain Allen Young, upon his recent voyage in the steam yacht *Fox*, and his careful and elaborate survey of the proposed telegraphic route between Europe and America, by way of the Færøes, Iceland, and Greenland.

FÆRØE ISLANDS.

This most interesting group of isles, the capital of which is Thors-haven, lies some 200 miles north of Scotland, and is under the authority of the Danish Crown. I will not occupy the time of the





